Acute Dyspnea and Decompensated Heart Failure

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KEYWORDS

- Acute heart failure • Emergency department • Risk-stratification • Observation units

KEY POINTS

- Use of lung ultrasound significantly improves diagnostic accuracy.
- Robust evidence to treat acute heart failure (AHF) in the emergency department setting remains poor. However, existing therapies improve symptoms and hemodynamics, although whether they improve outcomes is less well known.
- We propose a framework to ensure optimal management of the AHF patient, based on existing evidence. This is known as the 6-axis model.

INTRODUCTION

Few other acute presentations result in such paradoxic outcomes as acute heart failure (AHF). Patients feel substantially better with current treatment, yet outcomes are dismal: up to one-third of hospitalized patients experience death or rehospitalization within the next 3 months,[1] suggesting initial symptom improvement fails to substantially alter underlying pathology, akin to treating the fever yet ignoring the abscess. Improvements in hemodynamics alone has not led to improved outcomes, nor has any other targeted intervention.[2,3] The one possible exception being noninvasive ventilation.[4] Substantial efforts to improve outcomes have yielded poor returns on investment to date. Because most patients feel better, however, perhaps some consolation can be found.[5] With more than 1 million hospitalizations annually in the United States,[6] improving outcomes remains the greatest unmet need in AHF.

Background

The emergency department (ED) initiates hospital-based management for more than 80% of patients with AHF in the United States.[7–9] Patients most commonly present with shortness of breath or dyspnea.[10–12] Correct diagnosis is paramount yet can be challenging, given the broad differential for such a chief complaint, especially for patients with multiple comorbidities. Because there is no gold standard, heart failure remains a clinical diagnosis, diagnostic accuracy in the ED ranges from 71% to 86%.[13] At times, the patient's condition mandates treatment before a definitive diagnosis. Unfortunately, the evidence base for the pharmacologic management of AHF in the ED is poor, with no guideline recommendations meeting the highest Level 1, Class A grade.[14–16] Although modern day management has evolved away from rotating tourniquets and blood-letting, the remaining pharmacologic armamentarium for AHF management is largely the

same as 50 years ago.[17] Lack of evidence does not equal ineffective, only that we do not know whether current AHF pharmacologic treatment reduces rehospitalization or mortality. Nevertheless, patients require treatment. In this article, we present a framework for initial management.

Diagnosis

As mentioned, patients presenting in extremis requiring simultaneous treatment as the diagnosis is confirmed. However, for most patients, sufficient time exists to form an initial diagnostic and treatment plan.

It is worth reiterating; AHF is a clinical diagnosis. Thus, no single blood test, image, historical feature, or examination finding absolutely confirms the presence of heart failure (HF). In fact, the sensitivity of classic HF examination findings is quite poor. Although an S3 and jugular venous distention are quite specific, their sensitivity and interrater reliability are poor.[18] Natriuretic peptides improve diagnostic accuracy considerably.[19] However, a recent systematic review examining the clinical utility of natriuretic peptides using interval likelihood ratios, to better account for Natriuretic Peptides (NP) as a continuous variable, suggests the diagnostic "power" of NP lies more in ruling out AHF.[13] To "rule-in" AHF, lung ultrasound is one of the most useful, easy, and rapid tests to perform at the bedside[13,20] (Fig. 1). Although multiple scoring systems exist to quantify the number of B-lines,[21,22] the presence of multiple B-lines in at least 2 areas of each hemithorax facilitates confirmation of the diagnosis in the correct clinical setting.

Initial Classification in the Emergency Department

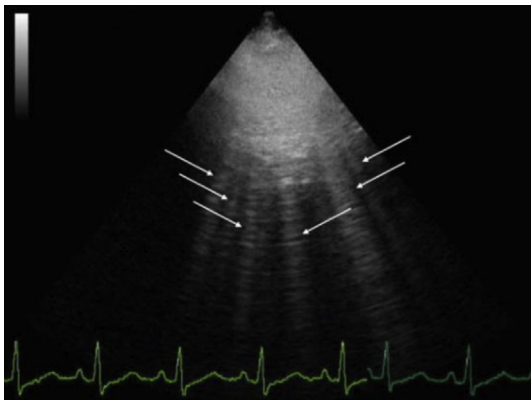Perhaps more than any other term, heterogeneity best describes the AHF population. In addition to

Fig. 1. Lung ultrasound. Arrows point to B-lines.

differences in cardiac structure and function, underlying etiology of HF, and precipitant of AHF, marked differences in patient characteristics, comorbid conditions, and background therapies, highlights the challenges of a singular, uniform construct to manage all AHF. As discussed in more detail as follows, we recommend the importance of thorough knowledge of underlying cardiac substrate, precipitants, and amplifying mechanisms of decompensation to best manage patients. This strategy accounts for patient differences. Nevertheless, some baseline characteristics are worth highlighting. Patients with AHF on average are older (73 years), with women comprising approximately half of AHF presentations.[23] Nearly half of patients with AHF have a relatively preserved (>40%) ejection fraction. Like AHF, no pharmacologic therapy definitively improves outcomes for patients with HF and a preserved ejection fraction (HFpEF).[14,16] This is a fundamental difference compared to HF with reduced EF (HFrEF), though mineralocorticoid receptor antagonists are a potential notable exception.[24] Irrespective of a reduced versus preserved EF, the comorbid burden for AHF is high, particularly for ischemic heart disease, diabetes, atrial fibrillation, and hypertension, as well as chronic obstructive pulmonary disease (COPD).

Given the heterogeneity of the patient population and presentation, combined with the lack of robust evidence, we propose a framework to aid the acute care provider in initial management. This is taken from the Gheorghiade and Braunwald[25] 6-axis model. Before in-depth discussion of the model, it is important to highlight what we consider less important in the ED setting regarding acute management.

Preserved Versus Reduced Ejection Fraction

ED management rarely differs based on ejection fraction (HFpEF vs HFrEF). Although these are the most commonly used terms currently, past terms such as diastolic dysfunction and systolic dysfunction have also been used to broadly describe patients based on EF. Such a lack of distinction in acute management is a striking difference compared with chronic HF.

Although knowledge of EF does not commonly change acute management, bedside or formal echocardiography (ECHO) may aid in diagnosing the extent and severity of right sided failure, presence of pericardial fusion, and valvular disease. Such knowledge may also aid in immediate management. At the present time, emergent ECHO is rarely performed in the ED setting outside of point-of-care ultrasound performed by emergency physicians.