PHILIPS

Ultrasound

# A patient with acute decompensated heart failure

A case study by

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## Philips Lumify case study

Patients presenting with acute decompensated heart failure (ADHF) may have left ventricular heart failure with reduced ejection fraction (HFrEF) or heart failure with preserved ejection fraction (HFpEF). Differentiation between the two is an important initial step in the clinical management of patients with ADHF because diagnostic and therapeutic strategies differ for these two groups of patients. Transthoracic echocardiographic (TTE) imaging is a class I recommendation in all patients with ADHF, in large part because of its ability to readily distinguish HFrEF and HFpEF. However, traditional full-featured TTE platforms and trained sonographers may not be immediately available at the patient's bedside at the time of admission. Point-of-care ultrasound can be invaluable when evaluating patients presenting with ADHF.

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## Clinical case

A 74 year-old male with long-standing hypertension, diabetes mellitus, and mild chronic renal disease presented to the emergency department at 8 pm, with seven days of progressive breathlessness. He has noted difficulty initially climbing stairs, but this has progressed to dyspnea when walking on level ground. The last two nights while sleeping he has found it difficult to lie flat without becoming breathless. He has also noted lower extremity edema. There has been no cough, fever, or leg pain. He has no sick contacts. The patient denies a prior history of cardiovascular disease, other than moderate essential hypertension. He is a non-smoker and non-drinker. There is no relevant positive family history. Medications include: metformin, amlodipine, and hydrochlorothiazide.

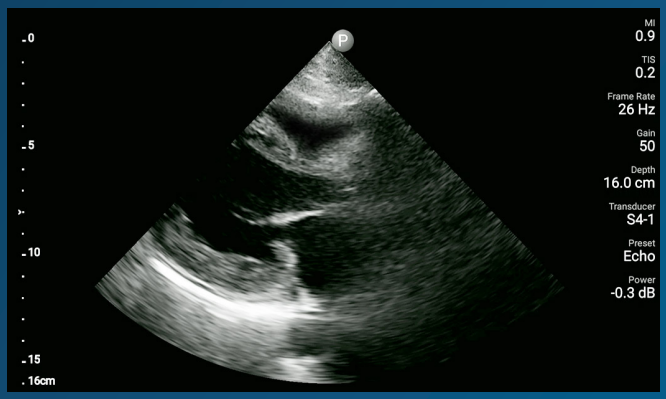
Physical examination is notable for an older, mildly obese black male in mild respiratory distress. Vitals: BP 108/60, pulse 92, respiratory rate 24, and afebrile. Lungs reveal crackles in the lower one third of chest. Heart sounds are normal, no murmur, no gallop noted, PMI cannot be felt and jugular venous pulse cannot be seen because of his large neck. He has 2-3+ lower extremity edema. Chest X-ray shows cardiomegaly and is otherwise consistent with mild CHF. EKG reveals normal sinus rhythm with left ventricular hypertrophy. Laboratory tests are notable for serum creatinine of 1.6 mg/dL, hemoglobin of 12.8 g/dL, normal liver function. His NT-proBNP is elevated at 4,300 pg/mL (normal < 300).

He is admitted to inpatient cardiology service with a diagnosis of ADHF. Therapy is initiated with intravenous diuretics and he makes 300 mL of urine with minimal improvement. Upon arrival to floor he is seen by the admitting physician, who is concerned about the relatively low blood pressure and elevated heart rate as well as only modest response to IV diuretic. The admitting physician is concerned about several things that have significant clinical management impact:

- Is the diagnosis of ADHF correct?
- Is the LV EF reduced such that an inotrope should be considered to augment diuresis?
- Is the enlarged cardiac silhouette on chest X-ray from a large pericardial effusion?
- Is the poor response to diuretic due to acute right heart failure?

The echocardiographic laboratory is closed for the day. However, the physician is trained in Focused Cardiac Ultrasound (FCU) and has access to a Lumify device.

The physician performs a focused cardiac ultrasound exam and obtains the following images.




**Parasternal long-axis**

- Left ventricular hypertrophy
- Moderately reduced LV EF
- Minimal pericardial effusion
- LA enlargement
- RV is not markedly enlarged

**Click here** to watch the video


**Parasternal short-axis**

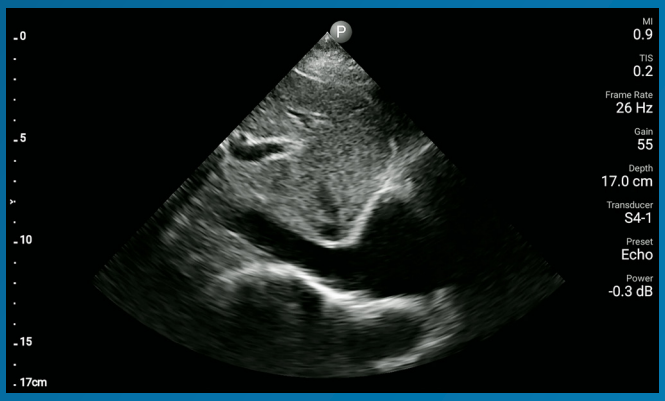
- Left ventricular hypertrophy
- Moderately reduced LV EF

**Click here** to watch the video


**Subcostal 4-chamber**

- Moderately reduced LV EF
- Minimal pericardial effusion
- RV is not markedly enlarged

**Click here** to watch the video




**Subcostal IVC**

- Dilated IVC with reduced respirophasic variation

**Click here** to watch the video

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**Clinical impact**

The impact of this *< 2 minute examination* is immediate and significant.

**Q:** Is the diagnosis of ADHF correct?
**A:** *All images support this diagnoses. There is LV systolic dysfunction, LA enlargement, and a dilated, plethoric IVC.*

**Q:** Is the LV EF reduced such that an inotrope should be considered to augment diuresis?
**A:** *Knowing that the LV EF is clearly reduced makes consideration of an inotrope very reasonable if there is no response to higher doses of diuretics.*

**Q:** Is the enlarged cardiac silhouette on the chest X-ray from a large pericardial effusion?
**A:** *There is clearly no significant pericardial fluid.*

**Q:** Is the poor response to diuretic due to acute right heart failure?
**A:** *The RV is small with preserved contractility.*

## Discussion

The rapid identification of HFrEF in a patient with ADHF allows appropriate early triage and management to include therapies that otherwise may not be indicated if LV EF is normal. This also contributes to avoidance of therapies contraindicated when LV EF is reduced.

Clinicians have traditionally relied on history and physical examination findings as well as CXR and laboratory data to make this distinction before cardiac imaging can be obtained. However, it is clear that bedside clinical evaluation using these tools is inadequate for accurate prediction of normal versus reduced LV EF.[1]

Echocardiography performed by trained sonographers in an accredited lab and interpreted by experienced readers is the test of choice for determining LV EF in patients with ADHF. However, for use at the bedside when a patient with ADHF is admitted and therapeutic decisions need to be made quickly, traditional platforms are large and cumbersome, and experienced sonographers may not be immediately available.

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Although FCU circumvents the impracticality of having a full platform device at the bedside during initial evaluation at any time of day or night for a patient admitted with ADHF, use of these devices still require training to gain the expertise to acquire and interpret the images.[2]

## Conclusion

Focused cardiac ultrasound using Lumify can be done rapidly at the bedside in patients admitted with suspected ADHF to provide confirmatory findings of ADHF, quickly differentiate HFrEF from HFpEF, and exclude other pathologies with similar presentation but require very different management.

## References


1. Razi R, Estrada JR, Doll J, Spencer KT. Bedside Hand-Carried Ultrasound by Internal Medicine Residents Versus Traditional Clinical Assessment for the Identification of Systolic Dysfunction in Patients Admitted with Decompensated Heart Failure. *J. Am. Soc. Echocardiogr.* 2011;24(12):1319-1324.
2. Spencer KT, Kimura BJ, Korcarz CE, Pellikka PA, Rahko PS, Siegel RJ. Focused Cardiac Ultrasound: Recommendations from the American Society of Echocardiography. *J. Am. Soc. Echocardiogr.* 2013;26(6):567-581.





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