

Prehospital Lung Ultrasound in Acute Heart Failure: Impact on Diagnosis and Treatment

Omkar Tamhankar MS, Michael Supples MD, Mark Liao MD, Patrick Finnegan MD, and Frances M Russell MD
Department of Emergency Medicine, Indiana University School of Medicine, Indianapolis, Indiana

BACKGROUND

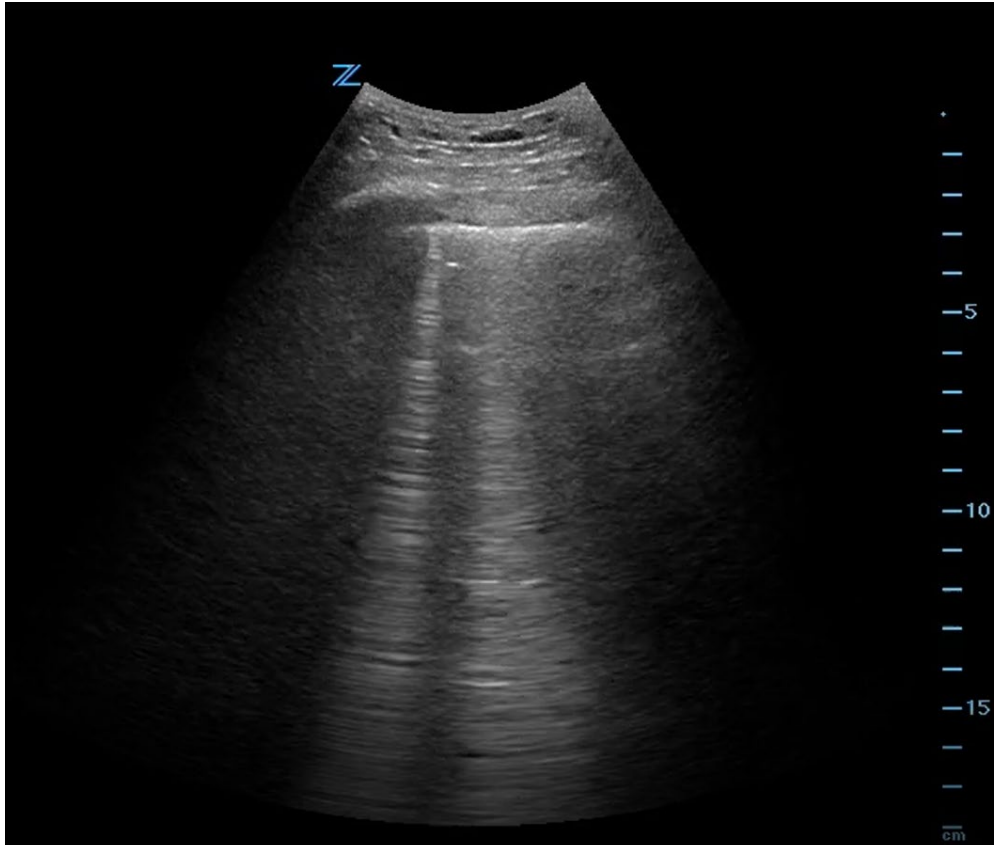
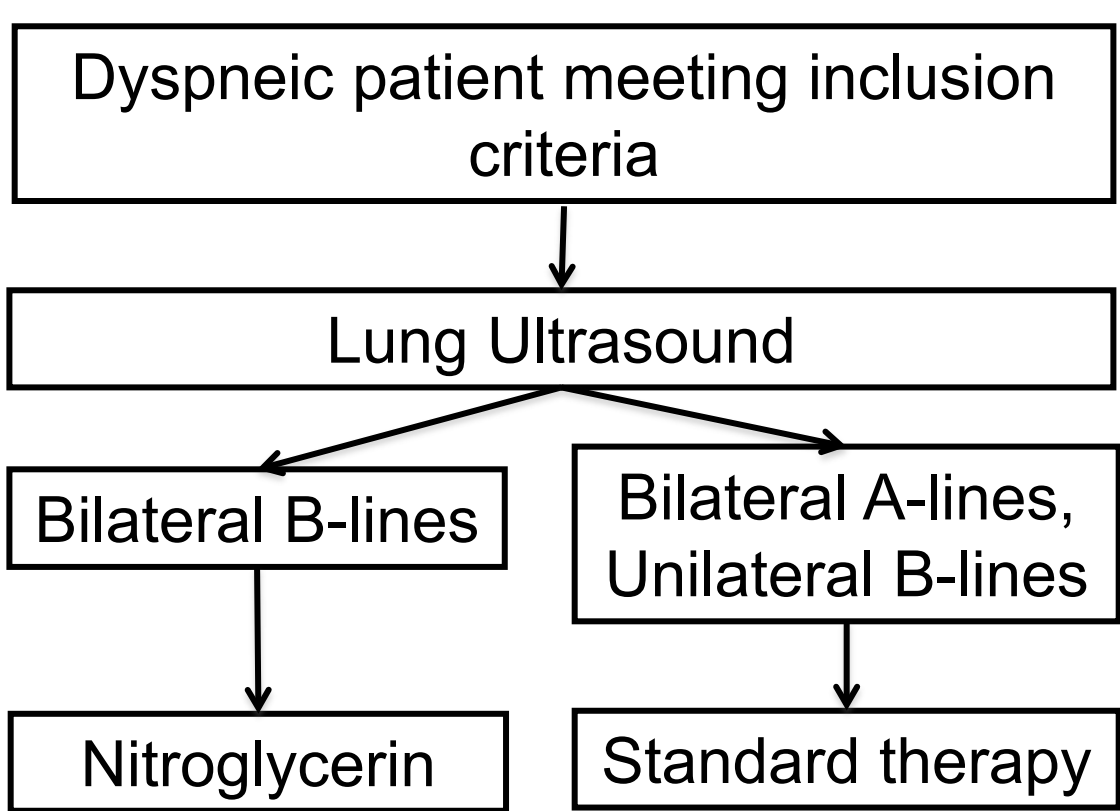
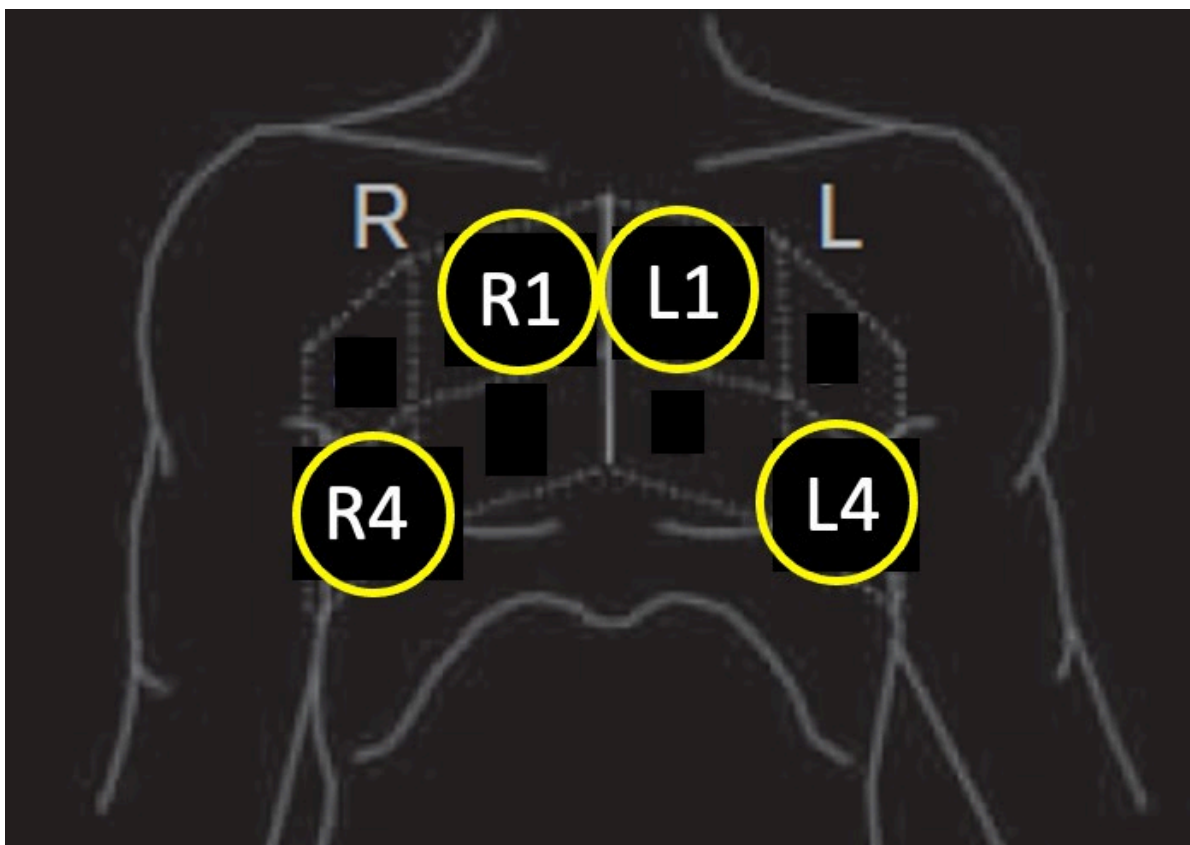
- In the United States, 1 million hospitalizations occur each year due to acute heart failure (AHF), with a one-year mortality rate of **27%**.
- Recent literature suggests that **early diagnosis and treatment is associated with an improved prognosis**.
- Prior research has also shown that prehospital **sensitivity and specificity** for diagnosing AHF is **14% and 98%**, respectively.

OBJECTIVES

- Diagnostic accuracy** of AHF by paramedics with and without LUS
- LUS impact on rate of **initiation** and **time to initiation** of HF therapy in AHF patients

METHODS

- Prospective study of patients (>18 years old) presenting with shortness of breath and at least one of the following: bilateral lower extremity edema, orthopnea, wheezing or rales on auscultation, increased work of breathing, tachypnea (RR>20) or hypoxia (oxygen saturation <92%)
- Patients meeting inclusion criteria had a paramedic-performed LUS to evaluate for the presence or absence of pulmonary edema
- A 4-zone LUS protocol was used. Pulmonary edema was defined as the presence of bilateral B-lines



RESULTS

Diagnosis of AHF	LUS	No LUS
Sensitivity	71% (95% CI 0.44-0.88)	23% (95% CI 0.12-0.34)
Specificity	96% (95% CI 0.76-0.99)	97% (95% CI 0.92-0.99)

- LUS improved frequency of treatment by **39%**
- Kappa for LUS interpretation was **0.79 (CI 0.6-0.98)**
- LUS improved median time to treatment by **130 minutes**
- LUS led to significantly **increased discharge** and significantly **decreased floor admission** rates compared to no LUS

	LUS (n=17)	No LUS (n=77)	p value
Prehospital			
Initiation of HF Therapy	9 (53%)	11 (14%)	0.001*
Median Time to Treatment	19 minutes	149 minutes	
ED Treatment			
Nitroglycerin	1 (5.9%)	11 (14.3%)	0.31
Albuterol	3 (17.6%)	34 (44.2%)	0.036*
Intubation	1 (5.9%)	3 (3.9%)	0.33
IV Fluids	3 (17.6%)	17 (22.1%)	0.49
Furosemide	5 (29.4%)	66 (85.7%)	0.00001*
Disposition			
Floor Admission	7 (41.2%)	53 (68.8%)	0.03*
ICU Admission	3 (17.6%)	16 (20.8%)	0.53
Discharge	4 (57.1%)	24 (31.2%)	0.005*

CONCLUSIONS

- Paramedic-performed LUS was highly **specific** and moderately **sensitive** for the diagnosis of AHF.
- This an improvement over **diagnostic accuracy** without the use of LUS (prior literature showing 14% sensitivity, 98% specificity).
- LUS significantly improved prehospital **initiation** of and decreased **time to treatment** of HF therapy