

Integration of Rapid Cardiopulmonary Ultrasound for Emergency Airway Management: The EASy Protocol

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Introduction

- Tracheal intubation is associated with significant morbidity and mortality in critically ill patients
- Point-of-care ultrasound (POCUS) has become increasingly common for management of respiratory and cardiac dysfunction
 - However, this analysis can be time consuming and limits its use in emergent situations
- Given this limitation, we suggest our novel POCUS protocol, Echocardiography Assessment using Subcostal only view (EASy) Exam, which is an abbreviated, algorithmic assessment of hemodynamic stability
 - EASy Exam consists of three views: subcostal four-chamber, IVC, and lung view
 - Patients are assigned to one of three main hemodynamic clusters, each with varying treatment courses
- We performed the EASy Exam on 30 patients with physiologically difficult airways (PDA) requiring emergency airway management (EAM) outside of the operating room

Methods

- We reviewed the electronic medical records of 30 patients undergoing EAM from June 1, 2019 to March 1, 2023 at a tertiary academic medical center
- Trained anesthesia residents performed the exam under the direct supervision of an attending
 - The exam was performed while the patient was being preoxygenated and the intubation equipment was being prepared
- Patient management was then tailored in accordance with their cluster classification to prevent peri-intubation hemodynamic instability

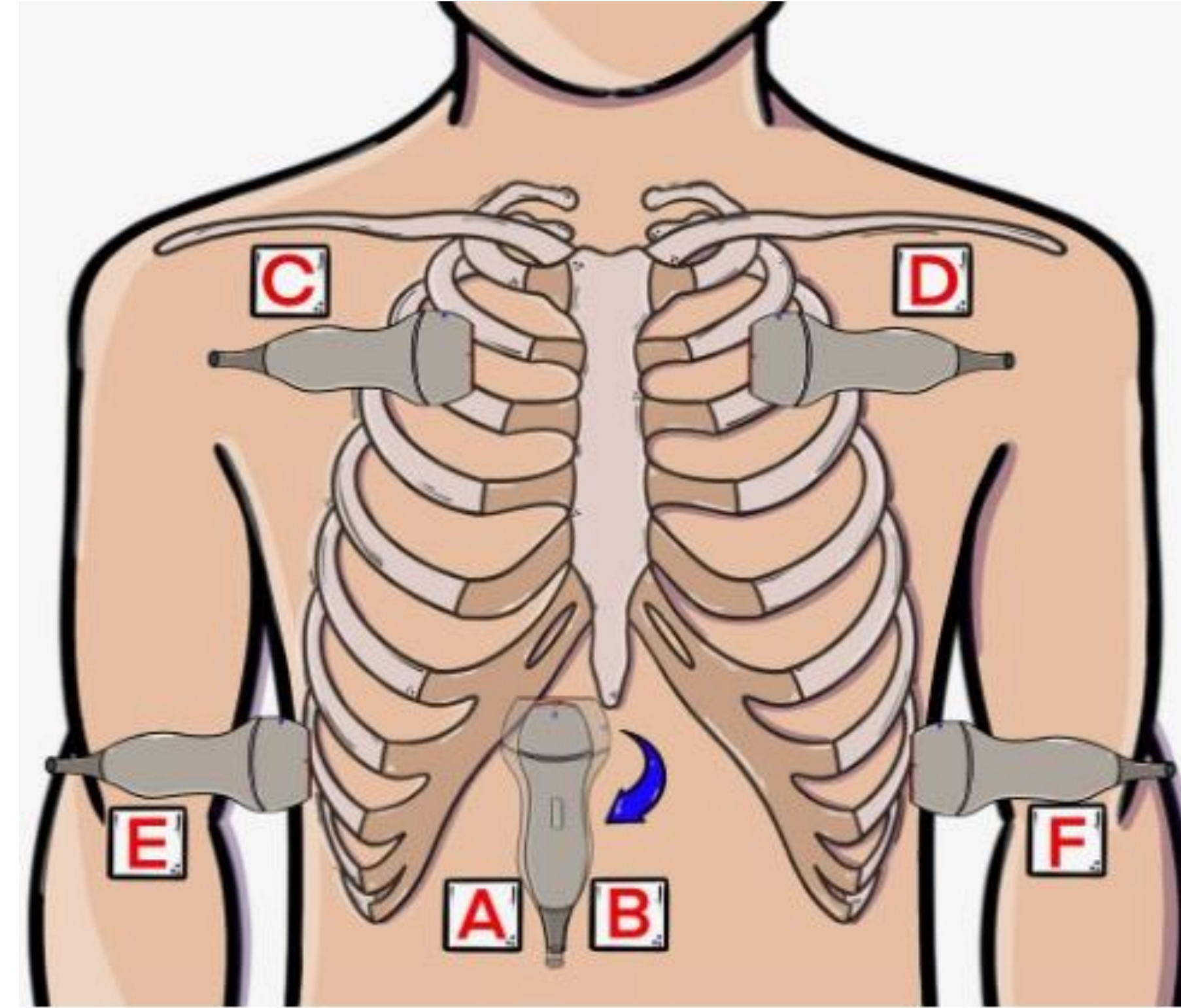


Figure 1. Point of care ultrasound (POCUS) Probe Placement in Echocardiography Assessment using Subcostal-only-view (EASy) exams.
The EASy examination is comprised of views to perform cardiac, gastric, and pulmonary assessment: (A) Subcostal four-chamber heart, IVC/aorta, gastric antrum (B) Midpapillary short-axis heart, (C)(D) Apical lung, (E)(F) Posterolateral diaphragmatic pleural recess.

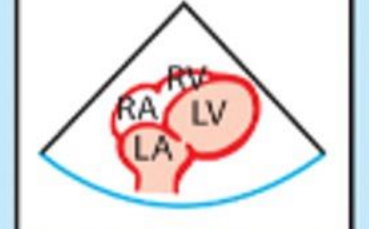
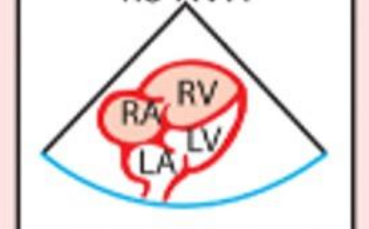
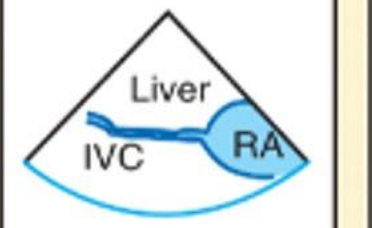
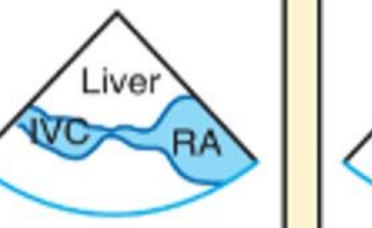
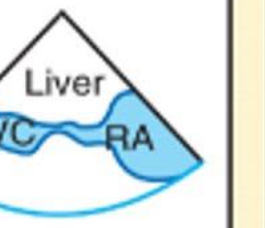
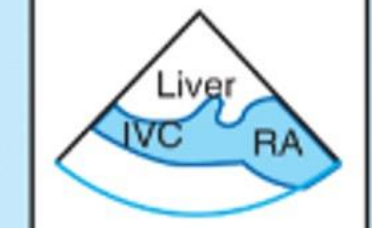
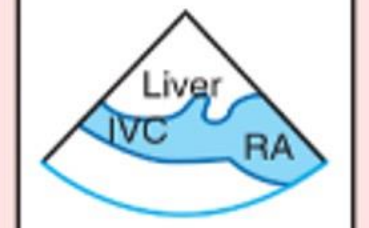
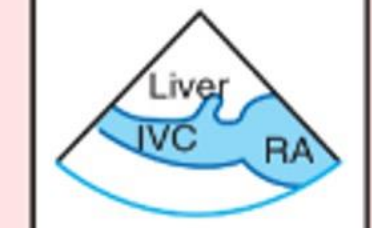
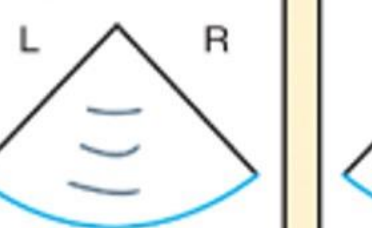
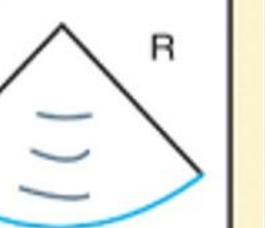
Cluster 1 Small/normal cavity Increase or normal global contractility			Cluster 2 Enlarged LV +/- RV cavity Decreased global contractility		Cluster 3 Isolated enlarged right ventricle Increase or normal LV contractility	
Phenotype 1	Phenotype 2	Phenotype 3	Phenotype 4	Phenotype 5	Phenotype 6	Phenotype 7
						
						
						
1	2	3	4	5	6	7
Hypovolemic shock	Distributive shock	Diastolic dysfunction +/- Hypovolemic +/- Distributive shock	Cardiogenic shock (pump failure) high pressure pulmonary edema		Acute isolated RV failure ARDS	Acute on chronic isolated RV failure ARDS pulmonary HTN

Figure 2. EASy phenotypes are based on the subcostal four-chamber view (top row), subcostal IVC view (middle row), and lung evaluation in the upper lung fields (bottom row). Cardiac assessment assesses myocardial performance, IVC evaluation provides an estimate of fluid responsiveness, and lung examination defines fluid tolerance (A pattern) and intolerance (B pattern).

Results

- The EASy Exam was performed on 30 patients, with subcostal images unable to be obtained in one patient due to severe abdominal pain
- The mean time to complete the exam was 2.4 minutes
- Of the remaining 29 patients, the EASy Exam was sufficient to alter management in 26 (86.7%) of patients
 - Alterations were primarily the type of induction agent used, type of fluid administered, and amount of fluid
- Two patients were found to have full stomachs, and a third was found to have a pericardial effusion

Discussion

- This study demonstrated the feasibility of integrating the EASy Exam into EAM in critically ill patients with PDA
- Results from the EASy Exam helped guide management by optimizing hemodynamic stability prior to intubation
- This novel protocol has the potential to reduce peri-intubation morbidity and mortality through tailored treatment
- Our study has limitations, including that it is a single-center study and lacks a control group to analyze changes in outcomes

References

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