Point-of-Care Ultrasound in Predicting Adverse Outcomes in Acute Pulmonary Embolism Patients

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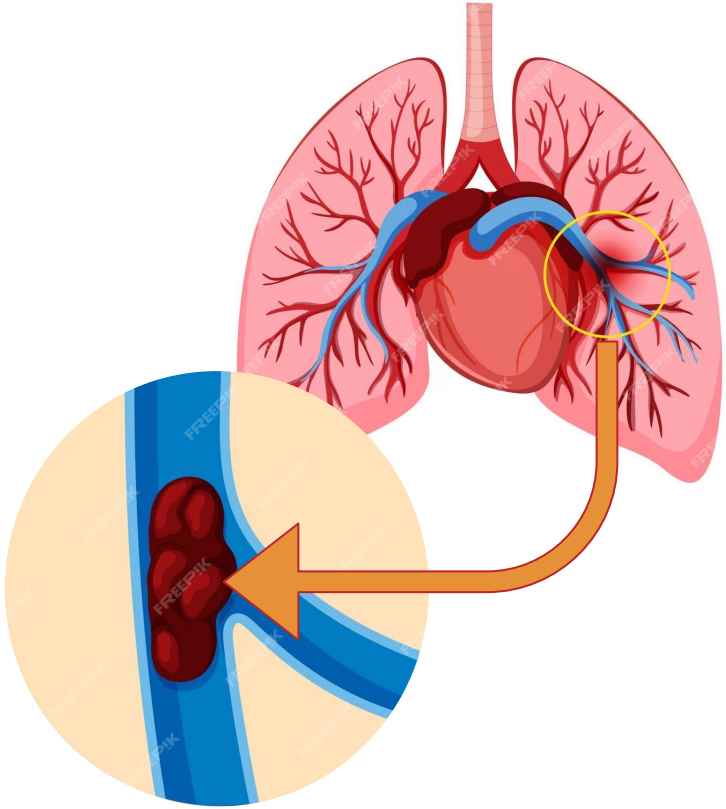
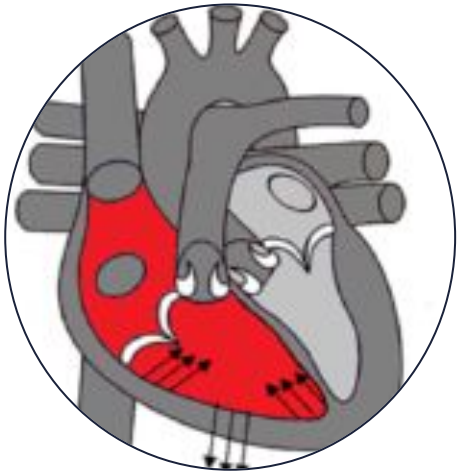
What is a pulmonary embolism (PE)?

- Blood clot usually formed in a deep vein in the legs or pelvis (deep vein thrombosis or DVT)
- Travels through the bloodstream and becomes lodged in one of the pulmonary arteries within the lungs
- Blockage causes RVD



How PE can lead to Right Ventricular Dysfunction (RVD)



- Right ventricle is responsible for pumping blood to the lungs for oxygenation
- Blood clot physically blocks blood flow to lung tissue, making RV increase strain and have reduced cardiac output

Risk Stratification in Pulmonary Embolism

- Clinical outcomes associated with pulmonary embolism (PE) vary widely
- Challenging to risk stratify and determine disposition
- Pulmonary Embolism Severity Index (PESI)
  - 11-element prediction tool to predict mortality in PE
- Point-of-care-ultrasound performed at bedside to assess for right ventricular dysfunction (RVD)
  - RV dilation, D sign, McConnell's Sign & Tricuspid annular plane systolic excursion (TAPSE)

Objective

- Evaluate accuracy of POCUS in predicting adverse short-term clinical outcomes in patients with acute PE compared to PESI

Methods

- Prospective, multicenter, observational study
- PESI calculated, POCUS to assess for RVD
- Received standard of care treatment
- Follow up chart review and telephone calls (7 and 30 days)

Inclusion Criteria	Exclusion Criteria
▪ 18 years of age or older ▪ ED Diagnosis of acute pulmonary embolism with identification on CT imaging	▪ Younger than 18 years of age ▪ Inability to provide informed consent ▪ Incarcerated individuals ▪ Current PE previously diagnosed (not initial visit)

Outcomes

Primary Outcome
- Composite within 5 days

Secondary Outcome
- Composite at 30 days
- Mortality at 5 days, 30 days

Composite Outcome
- Mortality
- Cardiovascular or respiratory intervention
- Vasopressor use
- New or worsening VTE
- Major bleeding
- Return to the ED
- Rehospitalization

Results

Demographic

- n = 214 patients across three sites
- Patients were 46.9% female

Age	
Mean	64
Median	66
Std. Dev.	16

PESI Class	n	%
1	35	16.4%
2	49	22.9%
3	51	23.8%
4	29	13.6%
5	50	23.4%

Results

Primary: Composite at 5 Days

Statistic [95% CI]	PESI >2	POCUS: RV Strain	PESI + POCUS
Sensitivity	69% [51-83%]	71% [54-85%]	89% [73-97%]
Specificity	41% [34-48%]	56% [49-64%]	27% [20-34%]
+LR	1.2 [0.90-1.5]	1.6 [1.3-2.1]	1.2 [1.0-1.4]
-LR	0.77 [0.46-1.3]	0.51 [0.30-0.87]	0.43 [0.16-1.1]

Results

Secondary: Composite at 30 Days

Statistic [95% CI]	PESI >2	POCUS: RV Strain	PESI + POCUS
Sensitivity	71% [59-81%]	52% [40-64%]	84% [73-92%]
Specificity	34% [36-53%]	54% [45-62%]	28% [21-36%]
+LR	1.3 [1.0-1.6]	1.1 [0.85-1.5]	1.2 [1.0-1.4]
-LR	0.7 [0.43-0.99]	0.89 [0.67-1.2]	0.56 [0.31-1.0]

Results

Mortality

	Statistic [95% CI]	PESI >2	POCUS: RV Strain	PESI + POCUS
5-day mortality = 2.3%	Sensitivity	80% [28-99%]	100% [48-100%]	100% [48-100%]
	Specificity	40% [33-47%]	53% [46-60%]	25% [19-31%]
	+LR	1.3 [0.84-2.1]	2.1 [1.9-2.5]	1.3 [1.2-1.4]
	-LR	0.50 [0.09-2.9]	0.0	0.0

	Statistic [95% CI]	PESI >2	POCUS: RV Strain	PESI + POCUS
30-day mortality = 5.1%	Sensitivity	91% [59-100%]	64% [31-89%]	100% [72-100%]
	Specificity	41% [34-48%]	53% [46-60%]	24% [19-31%]
	+LR	1.5 [1.2-1.9]	1.4 [0.84-2.2]	1.3 [1.2-1.4]
	-LR	0.22 [0.03-1.5]	0.69 [0.31-1.6]	0.0

Conclusions

- POCUS was more sensitive and specific than PESI in predicting adverse outcomes for ED patients with PE at 5 days
- The combination of POCUS + PESI yielded improved sensitivity, but with reduced specificity
- POCUS outperformed PESI and POCUS + PESI in predicting mortality at 5 days
- Neither PESI, POCUS, nor POCUS+PESI were > 98% sensitive for the composite outcome, but POCUS predicted all deaths at 5 days and POCUS + PESI predicted all deaths at 30 days.

Thank You!