Predictors of Pulmonary Embolism in Patients Hospitalized for COVID-19: A Multi-Center Study of 3,675 Patients

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Introduction

- Coronavirus Disease 2019 (COVID-19) is associated with an increased incidence of pulmonary embolism (PE).
- Both conditions increase hospital complications and mortality, especially when exhibited concurrently.
- Unfortunately, both conditions may present similarly, and physicians often have a difficult time finding clinical indicators to suggest pursuing further evaluation of a PE during a COVID-19 infection.

Methods

Using a multi-center facility database, we conducted a retrospective analysis of 3,675 COVID-19 patients at Methodist Health System from March 2020 to December 2020. COVID-19 infection was determined via molecular polymerase chain reaction testing and PE was determined by computed tomography (CT) scan with angiography. Patient demographics and laboratory values such as age, body mass index (BMI), past medical history, complete blood count, renal function panel, lactic acid, NT-proB-type Natriuretic Peptide (NT-proBNP), c-reactive protein (CRP), d-dimer, interleukin-6 (IL-6), and troponin were determined by a manual review of patient charts. D-Dimer was considered elevated at the level of 0.50 ng/mL, CRP at 10 µg/mL, troponin at 0.04 ng/mL, and lactic acid at 2mmol/L. Chi-Square test was used to analyze observed variables. Odds ratios were calculated for variables with a statistically significant difference ($p < 0.05$).

Results

Out of 3,675 patients hospitalized with COVID-19, 150 (4.1%) were found to have a PE on arrival.

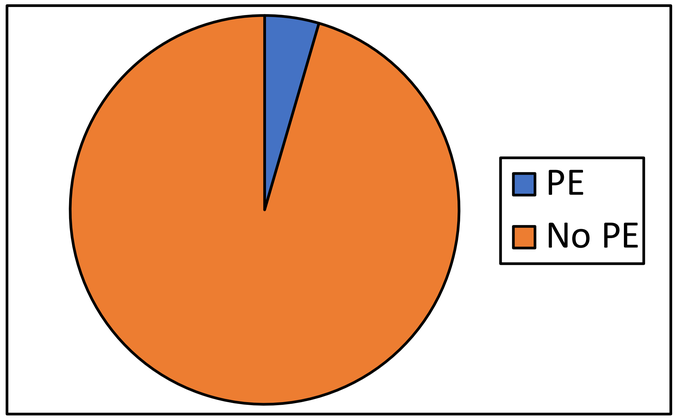

FIGURE 1. Distribution of Hospitalized COVID-19 Patients according to whether they suffered a PE on arrival

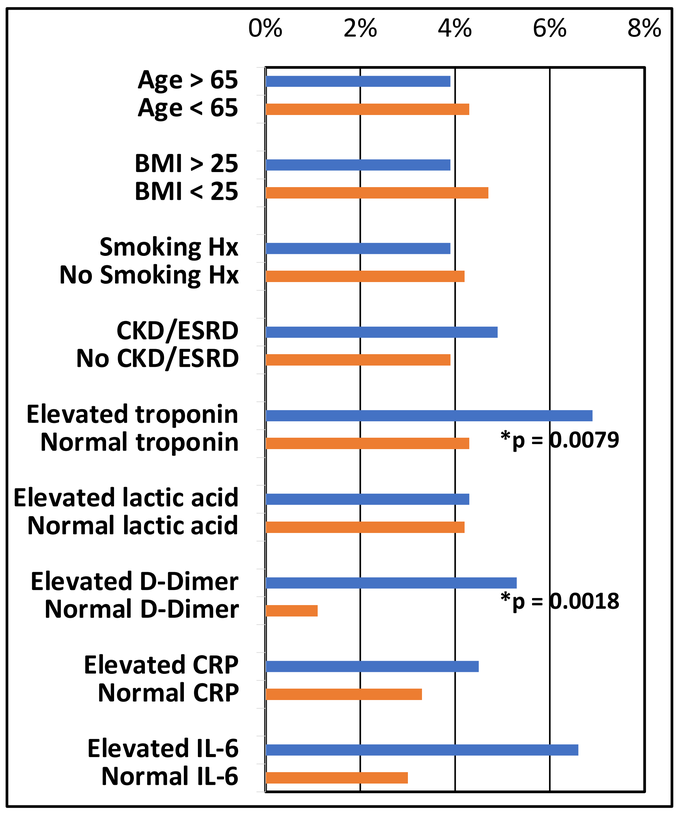

FIGURE 2. Risk of Pulmonary Embolism (%) by comorbidity or laboratory value.

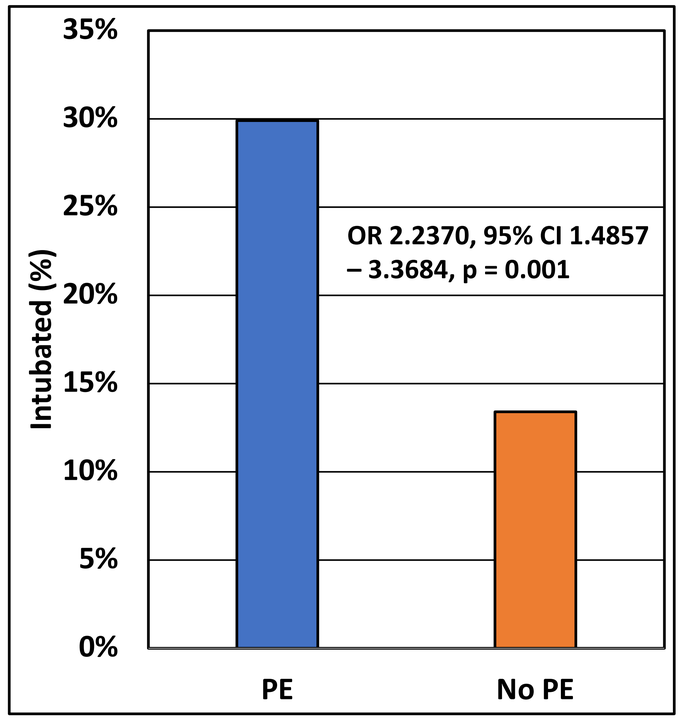

FIGURE 3. Comparison of incidence of intubation in patients in the PE vs. no PE groups.

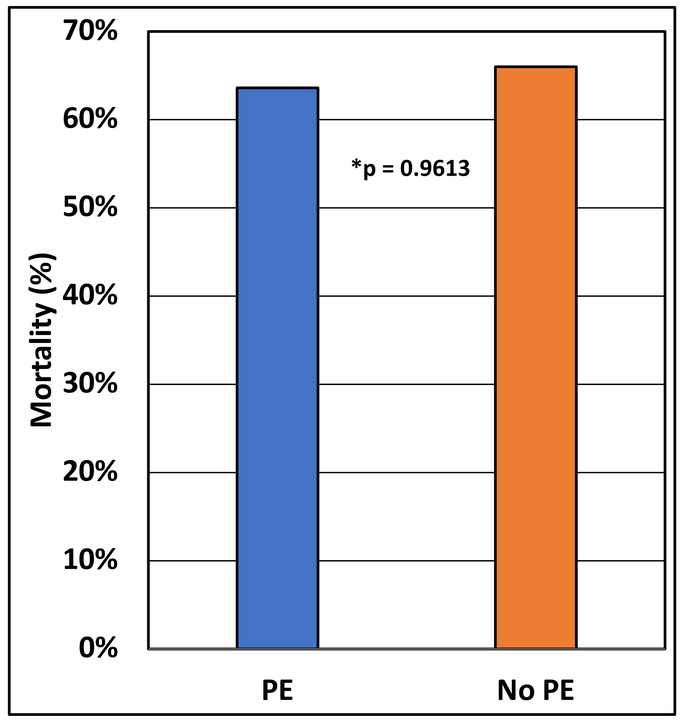

FIGURE 4. Comparison of in-hospital mortality incidence in the PE vs. no PE groups.

Highlights

Of the 3,675 patients diagnosed with COVID-19, 150 (4.1%) were diagnosed with PE **(Figure 1)**.

Elevated D-dimer (OR 4.9761, 95% CI 1.8184 – 13.6174, p = 0.0018) and troponin (OR 1.6652, 95% CI 1.1431 – 2.4259, p = 0.0079) levels were the only laboratory tests associated with a statistically significant increased rate of PE. Factors such as elevated C-reactive protein (p = 0.61), IL-6 (p = 0.26), lactic acid (p = 0.92), smoking history (p = 0.70), age over 65 (p=0.54), BMI over 25 (p = 0.42), and history of chronic kidney disease (p = 0.16) did not show a significant association with PE incidence **(Figure 2)**.

Of note, patients with PE during admission were seen to have an increased incidence of intubation (OR 2.2370, 95% CI 1.4857 – 3.3684, p = 0.001) **(Figure 3)**.

Furthermore, patients who underwent PE during hospitalization and were intubated did not have a statistically significant increase in incidence of mortality compared to patients who did not have PE but were also intubated (p = 0.9613) **(Figure 4)**.

Conclusion

D-Dimer and troponin can be used to determine whether patients hospitalized with COVID-19 may have concurrent PE. COVID-19 patients with PE have a higher incidence of intubation than those without PE.