



The Role of Biomarkers in Prediction of Mechanical Ventilation or Death in Patients with COVID-19

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BACKGROUND

Many healthcare systems have faced shortages in hospital and ICU beds as well as ventilators as the COVID-19 pandemic has evolved. The ability to predict disease severity is critical to resource allocation and safe patient care.

METHODS

We conducted a retrospective cohort study to assess the role of various biomarkers in predicting the composite risk of mechanical ventilation (MV) or death in patients with COVID-19. Specifically, the goal was to determine which lab values (including white blood cell count, lymphocyte count, platelet count, C-reactive protein (CRP), D-Dimer, lactate dehydrogenase (LDH), and ferritin) predicted mortality, ICU admission, and non-invasive or invasive ventilation. Additional variables included demographic data and clinical data including symptom onset, onset dyspnea, BMI, and presence of comorbidities such as hypertension, congestive heart failure, diabetes, and chronic lung disease. LASSO regression was used to identify the predictor variables with the strongest association with the composite outcome. For the variables with the strongest association, univariate receiver operating characteristic curves were constructed with MV or death being the composite outcome of interest. The integral of ROC curve provided detailed information of the change of probability of outcome with the full range of studied variable values.

Study population

Adult inpatients (age 18 and above) who were hospitalized between March 1st, 2020 and May 21st, 2020 with laboratory confirmed COVID-19 at the University of Colorado were included in the study. Patients who were pregnant or admitted to the rehabilitation unit were excluded.

RESULTS

Patient characteristics

A total of 604 patients were included in this study. Median age was 56 (interquartile range(IQR) 43 to 68), 44% were female, 22.2% were African-American, and 41.6% were Hispanic. Comorbidities included hypertension (49.2%), diabetes (38.1%), chronic lung disease (20.9%), and congestive heart failure (7.8%). Median BMI was 29.4 (IQR 25.8, 34.3).

Outcomes

57 patients experienced in-hospital mortality, and 186 experienced either MV or death. When the multivariable regression analysis used only the outcome of death, the strongest associated variables were age (OR 1.03 per year increase) and CRP (OR 1.36). The strongest predictors of a composite outcome of mechanical ventilation or death were CRP (Standardized OR 1.77) and LDH (OR 1.41). We noted a marked increase in the probability of MV or death above the 175 - 200mg/L range (Figure). Absolute and relative changes in repeat CRP or LDH were not significant predictors of the composite outcome. D-dimer was not a strong predictor of MV or death in a multivariable model.

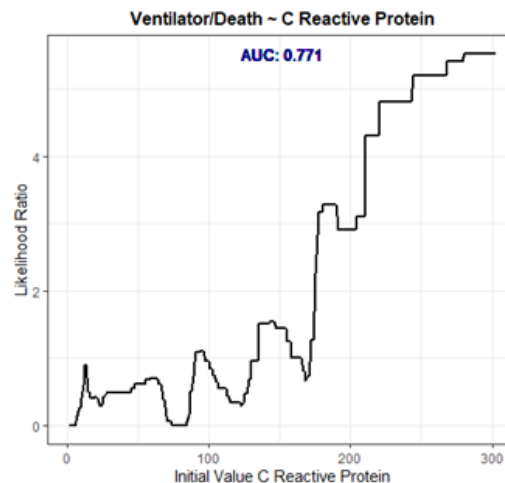


Figure: Change in the likelihood of death or mechanical ventilation with the initial C-Reactive Protein value

CONCLUSIONS

In our study, the initial CRP and LDH were strongly associated with MV or death. The role of other biomarkers in the risk stratification remains unclear.

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