Diagnostic Utility of a Ferritin to Procalcitonin Ratio to Differentiate Patients with COVID-19 from those with Bacterial Pneumonia

Katherine C. Jankousky, Peter Hyson, Jin Huang, Daniel B. Chastain, Carlos Franco-Paredes, Kristine M. Erlandson, Andrés F. Henao-Martínez, Leland Shapiro

School of Medicine
UNIVERSITY OF COLORADO
ANSCHUTZ MEDICAL CAMPUS

BACKGROUND

There is a clinical need to identify accurate and inexpensive biomarkers to help differentiate COVID-19 from bacterial pneumonia.

Ferritin (F) is a biomarker associated with cell lysis.

Procalcitonin (P) is a biomarker associated with cellular inflammation.

We hypothesize COVID-19 to be associated with more cell lysis (higher F) and less inflammation (lower P), resulting in a higher F/P ratio.

We hypothesize bacterial pneumonia to be associated with less cell lysis (lower F) and more inflammation (higher P), resulting in a lower F/P ratio.

METHODS

- A retrospective study on adult patients admitted through May of 2020 to the University of Colorado health system during the COVID-19 pandemic

- Calculations of the initial admission F/P ratios in patients diagnosed with either COVID-19 or bacterial pneumonia

- A logistic regression model to control for age, sex, body mass index (BMI), diabetes mellitus (DM), and hypertension (HTN)

- A receiver operating characteristic analysis to determine the sensitivity and specificity of F/P values in differentiating COVID-19 from bacterial pneumonia

Corresponding Author: Andrés F. Henao-Martínez, MD
andres.henaomartinez@cuanschutz.edu

Compared to bacterial pneumonia patients, a higher Ferritin to Procalcitonin (F/P) ratio was observed in COVID-19 patients (p=0.0003).

A F/P ratio of ≥1250 may provide a clinically relevant increase in pre-test probability to be a COVID-19 diagnosis and not a bacterial pneumonia case.
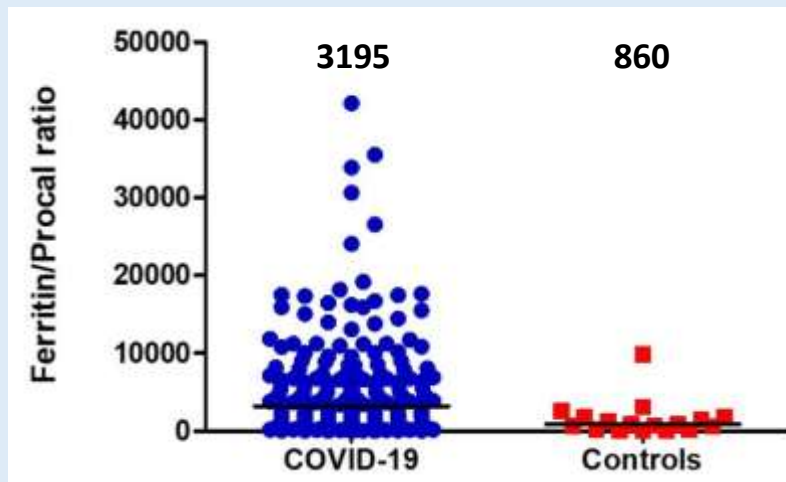
Figure 1. F/P ratios of patients with COVID-19 or bacterial pneumonia (controls). Black line represents medians.

RESULTS

218 COVID-19 cases, 17 bacterial pneumonia cases

COVID-19 patients were younger (56 vs 66 years, p=0.04), male (66% vs 24%, p=0.009), and had a higher BMI (31 vs 27 kg/m^2, p=0.03).

COVID-19 patients had similar rates of DM (32% vs 18%, p=0.2) and HTN (59% vs 45%, p=0.3) as bacterial pneumonia patients.

The median F/P ratio was significantly higher in COVID-19 patients (3195 vs 860, p=0.0003).

A F/P ratio of ≥1250 generated a sensitivity of 78% and a specificity of 59% to correctly classify a COVID-19 case.

This cutoff (PPV of 87.4%) correctly classified 68% of COVID-19 cases in patients in Georgia and China (N=80).
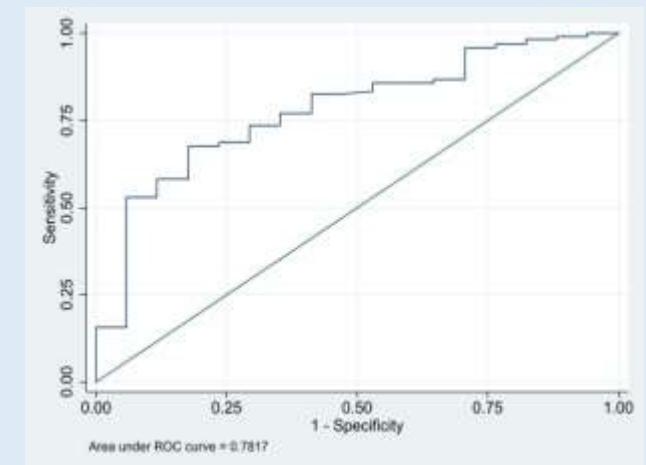
Figure 2. Receiver operating characteristic analysis of F/P ratio cutoff values predicting COVID-19 diagnosis.