Effects of Procalcitonin on Antimicrobial Treatment Decisions in Patients with COVID-19

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Background

- Procalcitonin (PCT) is often elevated in patients with bacterial pneumonia and septic shock
- PCT usually remains normal in viral infections, but can be elevated with severe COVID-19 infection
- Bacterial co-infections with COVID-19 are rare, but many patients still receive antibiotics

Methods

- Inclusion criteria: age ≥18 years, hospitalization at Michigan Medicine 3/1/20-10/31/21, positive for SARS-CoV-2, ≥1 PCT measurements
- Bacterial pneumonia (bPNA) categorized as:
  - **Proven**: met clinical and microbiologic criteria
  - **Probable**: met clinical but not microbiologic criteria and improved on antibiotics
  - **Possible**: met ≥ 1 clinical criterion (except hypoxia alone)
  - **No bPNA**: met no clinical or microbiologic criteria or had hypoxia alone as their presenting symptom
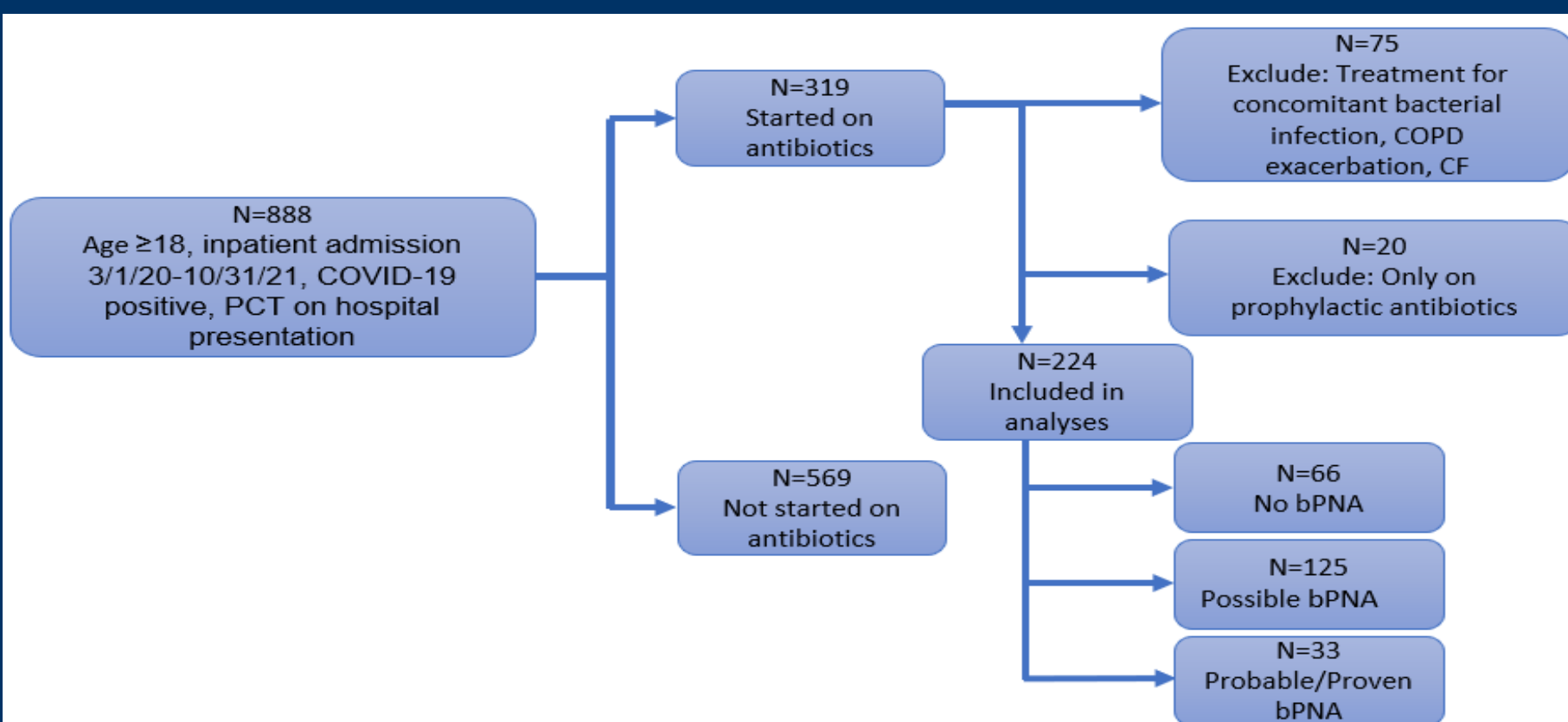
Aims

1) Characterize serum PCT trends during hospitalization for COVID-19

2) Assess the relation of PCT to bacterial pneumonia/superinfection

3) Assess how PCT trends relate to clinical decision making around antimicrobial use

Conclusions

- PCT was notably elevated in hospitalized patients with COVID-19, but elevations were more pronounced with bacterial co-infection
- Antibiotics were started in over a quarter of patients, even if bacterial co-infection was not present
- Serum PCT trends associate with both the decision to initiate antibiotics and duration of treatment, independent of bPNA status and comorbidities
- Future prospective studies should determine if PCT can be used to safely make decisions around antibiotic treatment for bacterial infection during COVID-19

Results

Group	PCT Measures Mean (SD)	PCT Measures Median (IQR)	Rate Ratio (95% CI) for PCT Measures	Initial PCT Mean (SD)	Initial PCT Median (IQR)	Odds Ratio (95% CI) for Group, Per 50% Increase in Initial PCT
No antibiotics	2.0 (2.6)	1 (1, 2)	Reference	1.06 (7.57)	0.14 (0.08, 0.28)	Reference
Antibiotics	4.1 (5.2)	2 (1, 5)	2.09 (1.82, 2.39)	4.10 (15.22)	0.53 (0.17, 1.48)	1.27 (1.20, 1.33)
No bPNA	3.1 (3.8)	2 (1, 4)	Reference	4.01 (17.27)	0.20 (0.12, 0.71)	Reference
Possible bPNA	5.0 (6.1)	3 (2, 6)	1.58 (1.20, 2.09)	3.27 (12.86)	0.65 (0.25, 1.45)	1.12 (1.03, 1.22)
Proven/Probable bPNA	3.3 (2.8)	2.5 (1, 3)	1.05 (0.71, 1.56)	7.41 (18.78)	0.88 (0.42, 5.17)	1.22 (1.09, 1.36)

Initial procalcitonin values by bPNA group and median antibiotic duration.
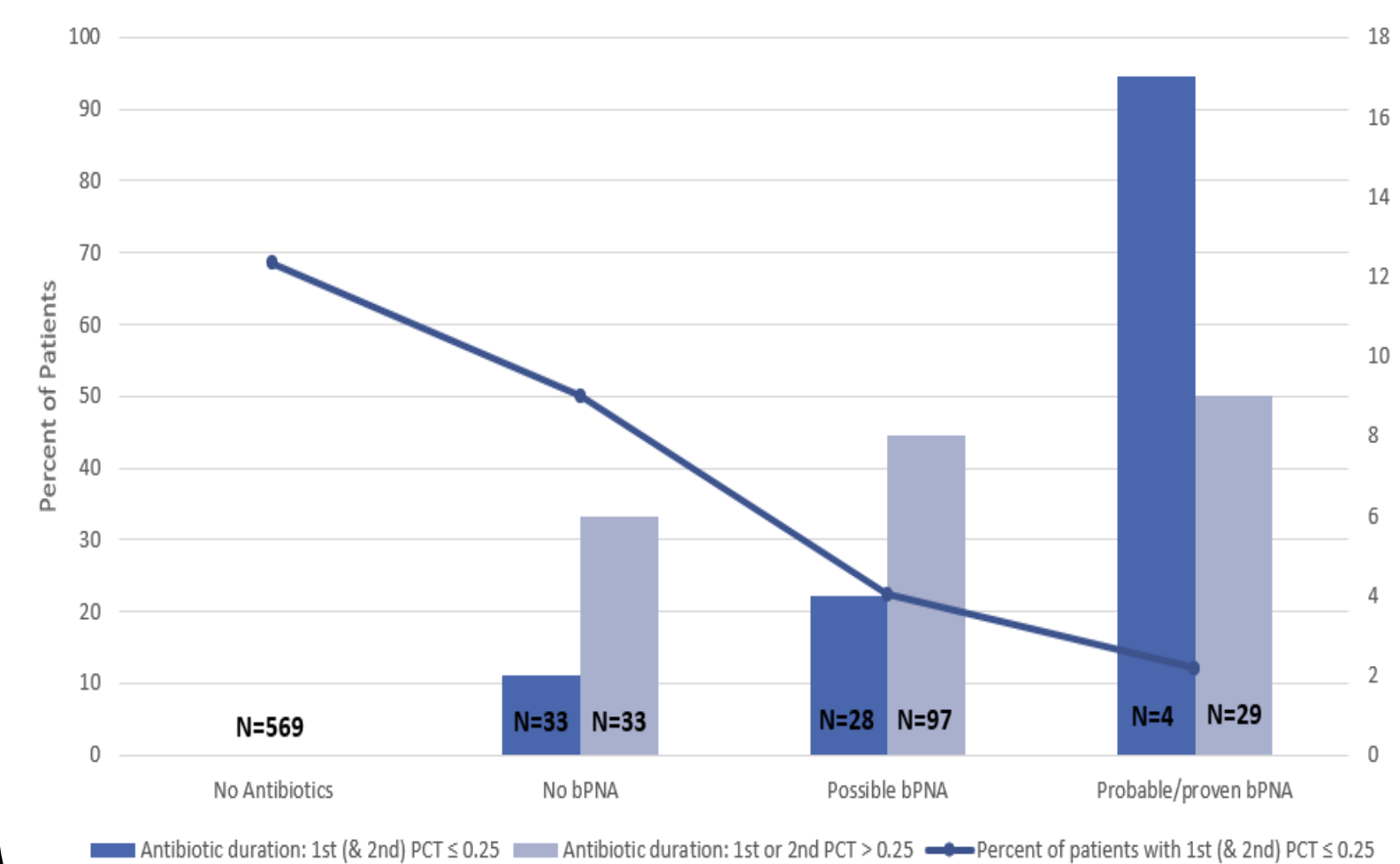
Logistic Regression Covariate for Antibiotic Initiation (n=793)	OR (95% CI)	P-value
Initial PCT, per 50% increase	1.23 (1.17, 1.30)	<.001
Time from start of pandemic, per 2-week increase	0.93 (0.92, 0.95)	<.001
Weighted Elixhauser, per unit increase	1.01 (1.00, 1.03)	0.03
Hypertension, yes vs. no	1.07 (0.68, 1.69)	0.76
Race, other vs. white	0.77 (0.52, 1.16)	0.10
unknown vs. white	2.39 (0.79, 7.21)	

Negative Binomial Regression Covariate for Antibiotic Duration (n=224)	RR (95% CI)	P-value
bPNA, none → possible → probable/proven	1.51 (1.23, 1.84)	<.001
Initial PCT, per 50% increase	1.04 (1.01, 1.08)	0.008
% Change in Daily PCT, per unit increase	1.03 (1.01, 1.05)	0.007
Time from start of pandemic, per 2-week increase	0.99 (0.98, 1.00)	0.06
Age, per year increase	0.99 (0.98, 1.00)	0.009