THE USEFULNESS OF PROCALCITONIN IN AIDING PHYSICIAN ASSESSMENT AND TREATMENT OF POTENTIAL SERIOUS BACTERIAL INFECTIONS

Jennifer K. Homa, MS[1]; Taylor A. Romdenne, BS[1]; Alex D. Christl, BS[2]; Ashley R. Heesacker, PA-C[3]; Darren M. Heesacker, MD[3]

[1] Advocate Aurora Research Institute, Advocate Aurora Health, Milwaukee, WI; [2] Emergency Department, Aurora BayCare Medical Center, Green Bay, WI; [3] Emergency Medicine, BayCare Clinic, Green Bay, WI

BACKGROUND

Procalcitonin (PCT) is used as a biomarker for the diagnosis of serious bacterial infections (SBI).[1,2] To date, studies have not compared PCT to clinical judgment and it remains unclear whether PCT adds to the physician's clinical judgment when diagnosing SBI.

OBJECTIVE

The current study evaluated the diagnostic usefulness of PCT in comparison to blood culture results and the physician's clinical judgment in patients presenting to the Emergency Department (ED) with signs of sepsis or other SBI.

METHODS

A prospective cohort study was conducted with 400 patients suspected of having sepsis or an SBI who presented to the ED at two community hospitals in Wisconsin from 2016 – 2018. PCT was performed on all patients in addition to the standard of care (SOC) for suspected SBI. PCT results were not available to the physicians throughout the duration of the study.

Physicians completed a brief survey that asked if they thought the patient was septic upon ordering SOC labs and again after they reviewed the SOC lab results. Chart reviews were conducted to collect study data and determine if patients were diagnosed with an SBI during their hospital stay.

Multivariate logistic regression was used to examine factors associated with an SBI diagnosis. All potential predictors that were found to be significant during univariate analysis at the p ≤ 0.10 significance level were included in the model.

The factors included in the model were PCT level[3,4], sex, blood culture result, ED volume/site, physician opinion of SBI pre-SOC labs, physician opinion of SBI post-SOC labs, temperature > 100.4ºF or temperature < 96.8ºF, heart rate > 90, WBC > 12K or WBC < 4K or WBC > 10% bands, glucose > 140 in absence of diabetes, lactate > 2 mmol/L, C-reactive protein > 5 mg/dL, and INR > 1.5 or PTT > 60 and not on anticoagulation.

A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

Among the patients, 186 (46.5%) were diagnosed with an SBI during their hospital stay.

PCT results were higher for patients who were diagnosed with an SBI (median = 0.46) than for those who were not diagnosed with an SBI (median = 0.12), U = 12365.5, z = -6.58, p < 0.001, r = 0.33.

Comparison of PCT Results by Diagnostic Groups
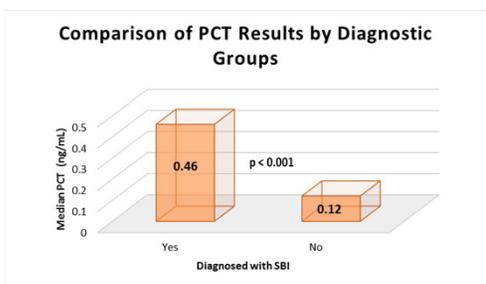
Multivariate logistic regression analysis showed that, when holding all other variables constant, high serum levels of PCT (≥ 0.25 ng/mL) were an independently significant predictor for an SBI diagnosis in patients with signs of infection (OR = 1.96, 95% CI: 1.13-3.39, p = 0.016).

In addition, patients suspected of having an SBI are 2.62 times more likely to be diagnosed with an SBI when the blood culture result is positive (OR = 2.62, 95% CI: 1.19-5.77, p = 0.017) and 7.13 times more likely to be diagnosed with an SBI when the physician believes the patient is septic after reviewing the SOC lab results (OR = 7.13, 95% CI: 3.64-13.97, p < 0.001).

There was no association between the physician's clinical judgment before reviewing the SOC lab results and SBI diagnosis (OR = 1.74, 95% CI: 0.88-3.45, p = 0.111).

None of the other factors, including lactic acid, were found to be significant predictors for an SBI diagnosis.
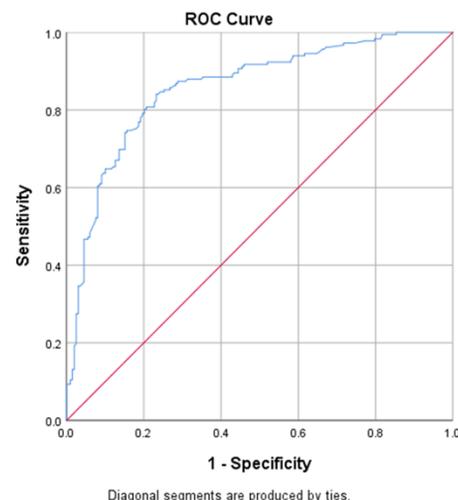
An ROC curve was used to evaluate the fit of the logistic regression model. The area under the curve (AUC) was 0.857 with 95% confidence interval (.819, .895), p < 0.001. This indicated the model was a good fit and classified the group significantly better than by chance.[5]

CONCLUSIONS

We found that PCT, blood culture results, and clinician judgment after reviewing SOC lab results provide important diagnostic value when diagnosing SBI.

Clinician judgment before reviewing SOC lab results was not associated with an SBI diagnosis, thus SOC lab results do have added value in aiding physician assessment of potential SBI.

This study offers a unique perspective as, to date, no other studies have compared PCT results to clinical judgment. Moreover, the methodology utilized in this study lends itself well to additional examination of clinician judgment in the hospital and clinic settings.

ROC Curve

Diagonal segments are produced by ties.

REFERENCES

1. Tang BM, Eslick GD, Craig JC, McLean AS. Accuracy of procalcitonin for sepsis diagnosis in critically ill patients: systematic review and meta-analysis. *Lancet Infect Dis*. 2007;7(3):210-217. doi:10.1016/S1473-3099(07)70052-X.
2. Pierrakos C, Vincent J-L. Sepsis biomarkers: a review. *Crit Care*. 2010;14(1):R15. doi:10.1186/cc8872.
3. Schuetz P, Chiappa V, Briel M, Greenwald JL. Procalcitonin algorithms for antibiotic therapy decisions: a systematic review of randomized controlled trials and recommendations for clinical algorithms. *Arch Intern Med*. 2011;171(15):1322–1331. doi:10.1001/archinternmed.2011.318.
4. Choe EA, Shin TG, Jo IJ, et al. The prevalence and clinical significance of low procalcitonin levels among patients with severe sepsis or septic shock in the Emergency Department. *Shock*. 2016;46(1):37-43. doi: 10.1097/SHK.0000000000000566.
5. Swets JA. *Signal Detection Theory and ROC Analysis in Psychology and Diagnostics: Collected Papers*. Mahwah, NJ: Lawrence Erlbaum Associates; 1996:94–117.

ACKNOWLEDGMENTS

CORRESPONDENCE

Jennifer.Homa@aah.org

Aurora Health Care®