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The Use of Procalcitonin as a Sepsis Marker in a Community Hospital

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Background

Procalcitonin (PCT) is a biomarker that aids in the diagnosis and monitoring of sepsis. Its levels begin to rise as soon as 3-6 hours after an infection is detected by the immune system. It has shown to be an early and highly specific marker in response to sepsis and severe systemic bacterial infections.

Purpose

This study explores and describes the use of PCT in a community hospital setting. We investigated its diagnostic accuracy in predicting sepsis and its usefulness as an early marker compared to lactic acid. It also explored the impact on patient care pre and post implementation of procalcitonin in regards to direct costs and length of stay for sepsis patients.

Methods

Two methods were utilized in this study:

- Method 1: Two comparative groups were analyzed in an exploratory descriptive case-control study with secondary analysis of retrospective data over a 19 month period after PCT implementation.
- Method 2: A control group consisting of emergency department patients were analyzed in a retrospective quasi-experimental study from a 19 month period before PCT implementation.

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Figure 1: Comparison of ROC curves between procalcitonin values and lactic acid values to predict sepsis status

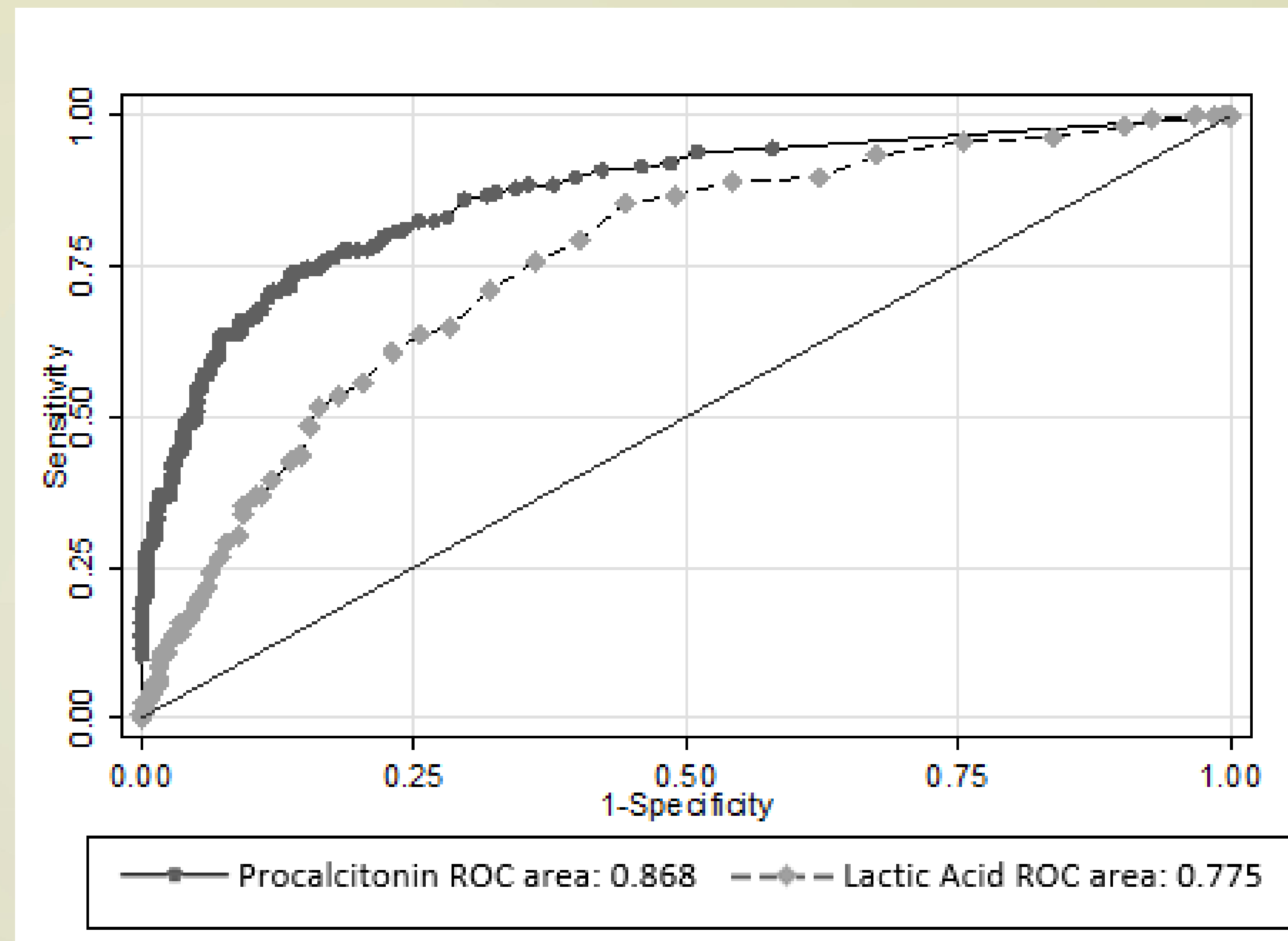


Table 1: Descriptive statistics of hospital costs and length of stay by group
 Pre-PCT data collection from May 2012 to December 2013, n= 69
 Post-PCT data collection from January 2014 to August 2015, n= 165

	Pre-PCT (median, IQR)	Post-PCT (median, IQR)	Test
Direct Costs (\$)	\$10,271 (5,586-16,643)	\$6,981 (4,558-12,576)	Z = 2.034, p = 0.042
Hospital LOS (days)	5 (4-9)	5 (3-9)	Z = 0.006, p = 0.995
ICU LOS (days)	2 (1-3)	2 (1-4)	Z = 0.037, p = 0.997
Time to first antibiotic administration (hours: minutes)	2:44 (1:40-4:50)	2:38 (1:31-3:59)	Z = 1.280, p = 0.200

Findings

There was a positive correlation between lactic acid and PCT values. In predicting sepsis cases with positive blood cultures, PCT (>0.1 ng/mL) had a sensitivity of 89.7% while lactic acid's sensitivity (>2mmol/L) was 64.9%. Also, there was a significant decrease in cost of hospitalization, where the median cost pre-PCT was \$10,271 and post-PCT was \$6,981. Neither, the length of stay (hospital or ICU) nor the time to the first antibiotic administration demonstrated a difference pre- and post- PCT implementation.

Discussion

We confirmed that PCT had a higher sensitivity in our hospital than lactic acid, offering a higher predictive usefulness in determining patients with positive blood cultures. From the results, it was suggested to lower the lactic acid cut off to 1.4mmol/L to improve sensitivity however, it decreased specificity and positive predictive value. The cost savings observed could be associated with a variable outside length of stay, or our measurement was not precise enough to show a decrease in length of stay.

Implications for Practice

In our community hospital, a majority of admitted patients are first treated in the emergency department. As discussed, PCT is a better tool than the traditional lactic acid and this has resulted in increased acceptance and utilization in the emergency room and hospital units. Typically the length of stay has the greatest influence on cost, so further review is needed to improve it and pinpoint savings. Additionally, we need to investigate if time to treat or treatment plan also attributes to cost savings.