

ABSTRACT

Introduction

Procalcitonin (PCT) is an inflammatory marker that increases primarily in response to bacterial infections. In patients with sepsis, higher levels of PCT are associated with more severe disease. PCT concentrations increase in patients with more severe stages of sepsis and in patients with more severe organ dysfunction. Therefore, we hypothesize that PCT may correlate with severity of disease in hospitalized patients with CAP.

The objective of this study was to define if an association exists between PCT and the severity of CAP as defined by the Pneumonia Severity Index (PSI).

Methods

This was a secondary data analysis of the Community-Acquired Pneumonia Organization (CAPO) International Cohort Study database. The association between PCT and PSI risk class was evaluated using boxplots, jitter plots, and the Kruskal-Wallis test.

Results

A total of 506 patients were included in the study. There was no association between PCT levels and PSI (P=0.54).

Conclusions

This study failed to define an association between PCT and PSI in hospitalized patients with CAP. Patients with severe CAP present to the hospital with a higher inflammatory response. One explanation of our results is that PCT may not be a good marker of the level of inflammatory response.

MATERIALS AND METHODS

Study design and Study population

This was a secondary analysis of patients enrolled in the Community-Acquired Pneumonia Organization (CAPO) international cohort study. Data were collected between 2009 and 2015. In each participating center, non-consecutive medical records of hospitalized patients with the diagnosis of CAP were reviewed. A sample of the data collection form is available at the study website (www.caposite.com). Validation of data quality was performed at the study center before the case was entered in to the CAPO database. Institutional Review Board approval was obtained by each participating center.

Study definitions

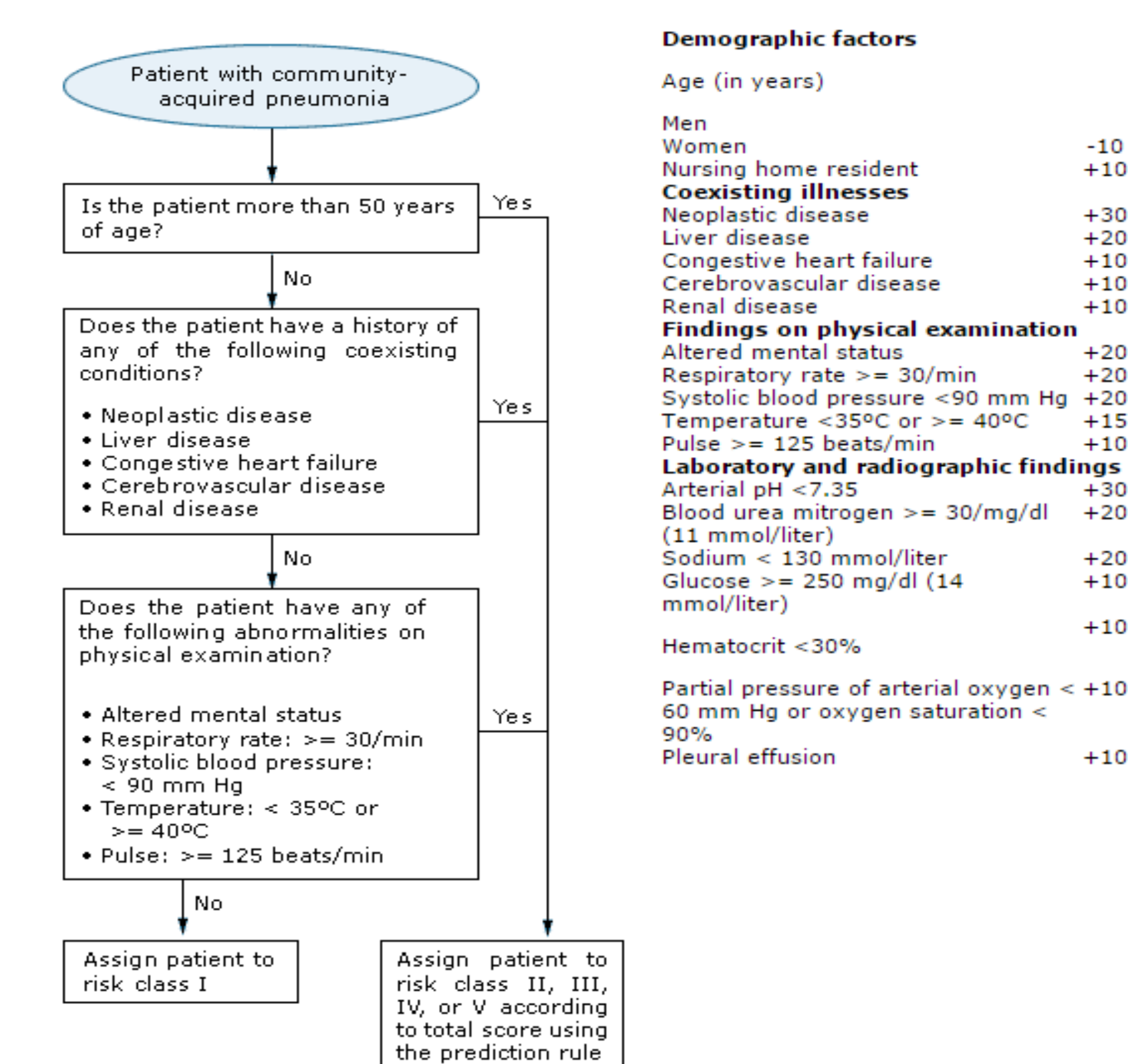
CAP: Diagnosis of CAP required the presence of criterion A, B, and C:

- New pulmonary infiltrate on imaging (CT scan or chest x-ray) at the time of admission to the hospital.
- Signs and Symptoms of CAP (at least one of the following)
 - New or increased cough (per the patient)
 - Fever >37.8°C (100.0°F) or hypothermia <35.6°C (96.0°F).
 - Changes in WBC (leukocytosis >11,000 cells/mm³, left shift > 10% band forms/microliter, or leukopenia < 4,000 cells/mm³
- Working diagnosis of CAP at the time of hospital admission with antimicrobial therapy given within 24 hours of admission.

Pneumonia Severity I (PSI)

PSI is a tool utilized by physician to assess severity of CAP in the ED with the goal of assisting with the decision of treatment location based on the risk of death. It has a two-step calculation. (Table 1)

Table 1: Pneumonia Severity Index (PSI)



Statistical Analyses

Baseline categorical explanatory variables were summarized as frequencies and percentages. Continuous variables were summarized as frequencies and interquartile range.

RESULTS

- A total of 506 patients were included in the study
- Patients' characteristics are shown in table 2
- The association between PCT and severity of disease based on PSI is shown in figure 1. No statistically significant association was found (P=0.54).

Table 2: Patients' characteristics

Patient Characteristic Chart n=506	
Variable	Value
Demographics	
Age, Median (IQR)	71 (23)
Sex, n(%)	340 (67.2)
Nursing home resident, n(%)	30 (5.9)
Comorbid Conditions	
Congestive Heart Failure, n(%)	97 (19.2)
COPD, n(%)	132 (26.1)
Diabetes, n(%)	114 (22.5)
HIV, n(%)	0 (0)
Chronic Renal Failure, n(%)	81 (16)
Liver Disease, n(%)	32 (6.3)
Neoplastic Disease, n(%)	70 (13.8)
Physical Exam	
Altered mental status on admission, n(%)	53 (10.5)
Respiratory Rate, Median (IQR)	22 (7.2)
Systolic blood pressure, Median (IQR)	130 (34)
Temperature (degrees Celsius), Median (IQR)	37.8 (1.6)
Heart rate, Median (IQR)	98 (27.5)
Lab/Radiography	
PaO2, Median (IQR)	61 (17.2)
pH, Median (IQR)	7.5 (0.1)
Blood Urea Nitrogen, Median (IQR)	30 (27.2)
Serum sodium, Median (IQR)	137 (6)
Serum glucose, Median (IQR)	122 (54.5)
Hematocrit, Median (IQR)	39 (6.6)
Pleural effusion, n(%)	139 (27.5)
Severity of Disease	
ICU admission, n(%)	42 (8.3)
Pneumonia Severity Index, Median (IQR)	122 (47.8)

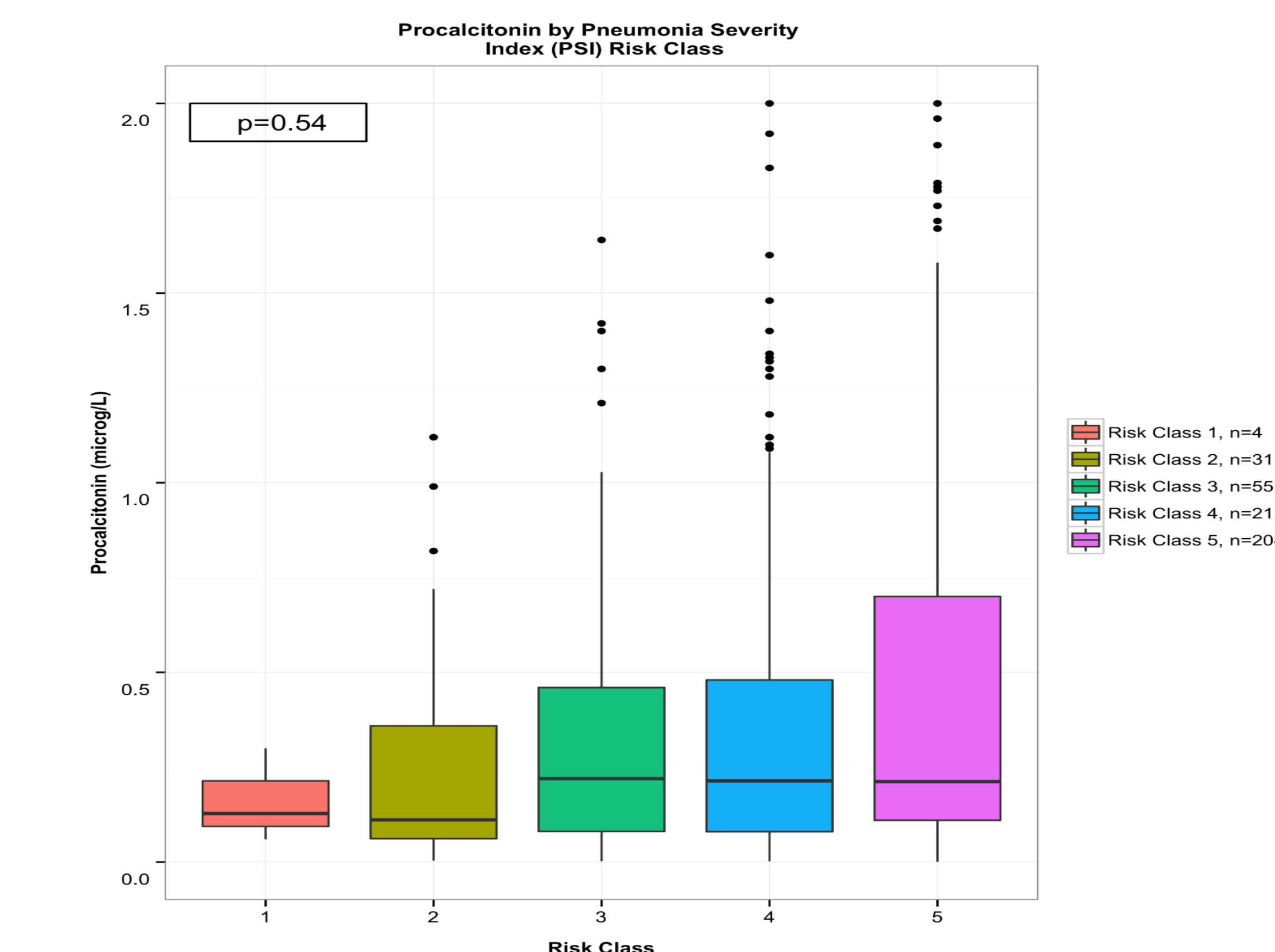


Figure 1: Association between PCT and severity of CAP based on PSI

CONCLUSIONS

- This study failed to define an association between PCT and PSI in hospitalized patients with CAP.
- One explanation of our results is that PCT may not be a good marker of the level of inflammatory response.
- Another possible explanation is that viruses are a common etiology of CAP (although not routinely identified due to limited testing) and therefore the lack of correlation since PCT is not increased in viral infections.
- It is worth noted that the median age in our population was 71 years, which may be indicating some degree of immunodeficiency due to age and a weakened immune response.
- Further research may be needed to define the applicability of PCT as a marker of severity of CAP.

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INTRODUCTION

Procalcitonin (PCT) is an inflammatory marker that increases primarily in response to bacterial infections. It is a precursor of the hormone calcitonin, produced in the medullary C-cells of the thyroid gland and associated with calcium metabolism [1, 2]. PCT is produced in the parenchymal cells in response to microbial toxins or inflammatory mediators such as interleukin (IL)-1b and tumor necrosis factor (TNF)-a [3]. The level of PCT in healthy individuals is less than 0.1 ng/mL [4] and remains low in individuals with viral and non-infectious diseases [5].

In patients with sepsis, higher levels of PCT are associated with more severe disease. PCT concentrations increase in patients with more severe stages of sepsis and in patients with more severe organ dysfunction. PCT also correlates with severity scores use in the ICU such as SOFA score [6]. Therefore, we hypothesize that PCT may correlate with severity of disease in hospitalized patients with CAP.

The objective of this study was to define if an association exists between PCT and the severity of CAP as defined by the Pneumonia Severity Index (PSI).